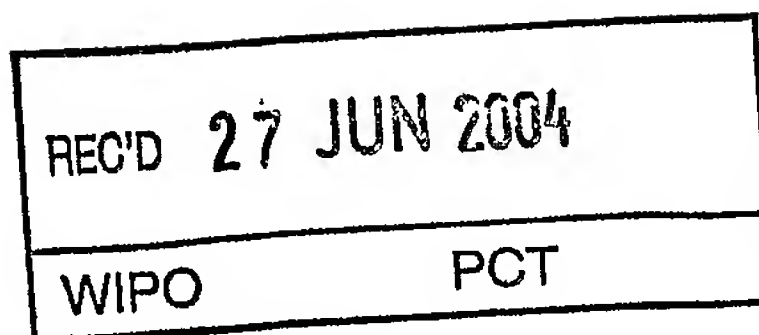


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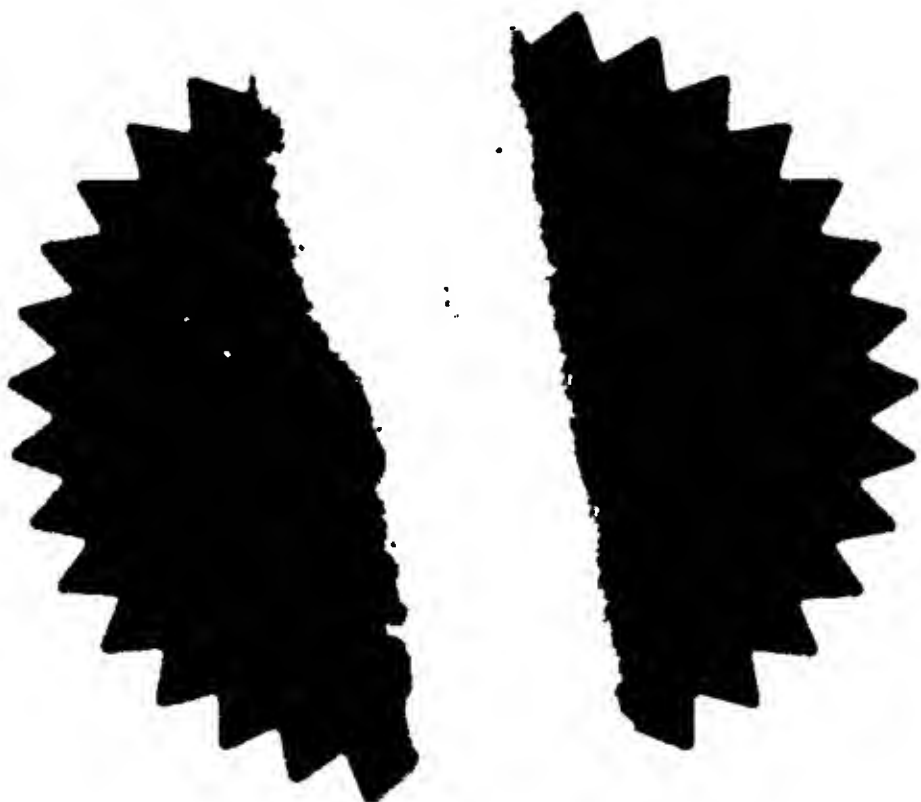
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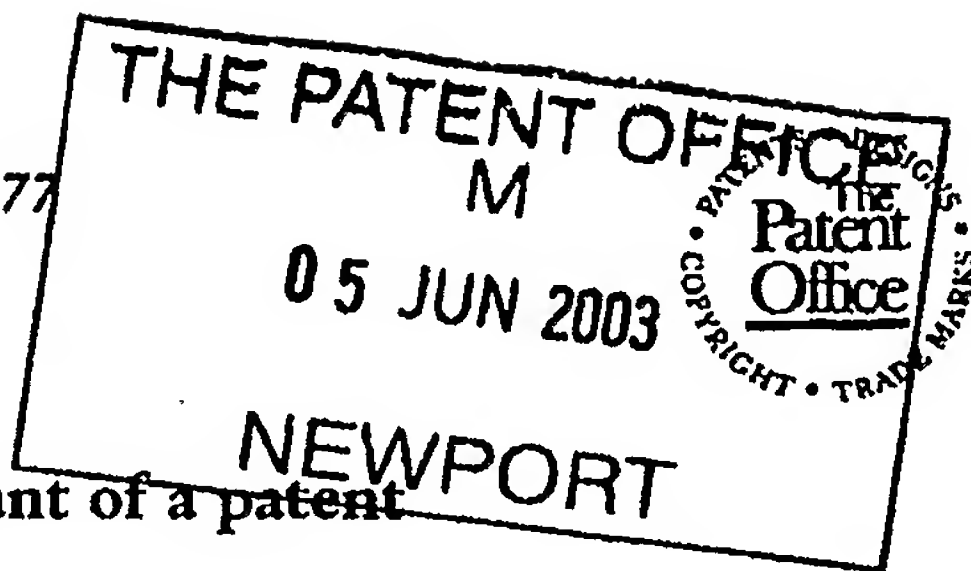
Andrew Cerey

Dated 28 February 2007

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P01/7700 0.00-0312903.8

1/77

The Patent Office
Concept House
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Newport
Gwent NP10 8QQ

1. Your reference

2369-P101-GB

2. Patent application number

0312903.8

New

5 JUN 2003

3. Full name, address and postcode of the or of each applicant (*underline all surnames*)

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Patents ADP number (*if you know it*)

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If the applicant is a corporate body, give the country/state of its incorporation

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4. Title of the invention

Generator

5. Name of your agent

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Patents ADP number

7807043001

6. If you are declaring priority from one or more earlier patent applications, give the country and the date of filing of the or of each of these earlier applications and (*if you know it*) the or each application number

Country

Priority application number
(*if you know it*)

Date of filing
(*day/month/year*)

N/A

N/A

N/A

7. If this application is divided or otherwise derived from an earlier UK application, give the number and the filing date of the earlier application

Number of earlier application

Date of filing
(*day/month/year*)

N/A

N/A

8. Is a statement of inventorship and of right to grant of a patent required in support of this request?

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Description

Claim(s)

Abstract

Drawings

21 20 (P.S.M.)
06 ✓
01 ✓
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Priority documents

N/A

Translations of priority documents

N/A

Statement of inventorship and right to grant of a patent (Patents Form 7/77)

None

Request for preliminary examination and search (Patents Form 9/77)

One ✓

Request for substantive examination (Patents Form 10/77)

None

Any other documents (Please specify)

11.

I/We request the grant of a patent on the basis of this application.


Signature

Date Wednesday, 04 June 2003

12. Name and daytime telephone number of person to contact in the United Kingdom

RALPH ATKINSON CPA
0114 275 2400

DUPLICATE

Generator

Background of the Invention

1. Field of the Invention

5 The present invention relates to a generator, in particular a wind powered generator.

2. Description of the Related Art

10 A first type of wind powered generator utilises a bladed rotor mounted on a vertical post. The rotor is configured to rotate about an axis of rotation when exposed to air flowing in a direction along that axis of rotation.

 A second type of wind powered generator utilises a bladed rotor configured to rotate about an axis of rotation when exposed to air flowing in a direction perpendicular to that axis of rotation.

15 A wind powered generator of this second type is disclosed in United Kingdom Patent number 2 341 646 B, in the name of the present applicant.

Brief Summary of the Invention

20 According to a first aspect of the present invention there is provided a generator for generating an electric current comprising current generating means comprising first generator means and second generator means arranged to generate electric current in response to relative rotation between said first and second generator means; a first rotary part having vanes, said first rotary part arranged to rotate in a first direction around an

axis when exposed to a flow of air perpendicular to said axis; said first rotary part operatively connected to a first of said first and second generator means; wherein said generator further comprises first rotary part barrier means arranged in stationary relation to said first rotary part, said barrier means configured to provide a barrier sector comprising a barrier around a portion of the vane free edge path of said first rotary part, said barrier extending between an air inlet region in which a portion of the vane front edge path is exposed to allow the underside of a vane to be exposed to a flow of air, and an air outlet region in which a portion of the vane front edge path is exposed to allow the underside of a vane to be exposed following rotation through said barrier sector to allow the discharging of air, said barrier means configured to inhibit air which follows a vane rotating into said barrier sector from discharging outside of the vane free edge path whilst said vane is rotating through said barrier sector.

According to a second aspect of the invention there is provided a generator for generating an electric current comprising current generating means comprising first generator means and second generator means arranged to generate electric current in response to relative rotation between said first and second generator means; a first rotary part having vanes, said first rotary part arranged to rotate in a first direction around an axis when exposed to a flow of air perpendicular to said axis; said first rotary part operatively connected to a first of said first and second generator means; a second rotary part having vanes, said second rotary part arranged to rotate in a second opposite direction around said axis when

exposed to a flow of air perpendicular to said axis; said second rotary part
operatively connected to a second of said first and second generator
means; and said axis is through an axial shaft about which said rotary parts
are arranged to rotate, wherein said axial shaft is configured to receive
5 electrical connection means therethrough, said electrical connection means
configured to provide an electrical connection between said current
generating means and generator electrical means.

Brief Description of the Several Views of the Drawings

10 The invention will now be described by way of example only, with
reference to the accompanying drawings in which:

Figure 1 shows a wind powered generator embodying the present
invention;

15 *Figure 2* shows an example of a rotary part utilisable in a wind
powered generator embodying the present invention;

Figure 3 shows rotary part barrier means arranged in stationary
relation to the rotary part shown in *Figure 2*;

Figure 4 shows a simplified section view, along line I-I of *Figure 1*,
through a first rotary section of the wind powered generator of *Figure 1*;

20 *Figure 5* shows a simplified section view, along line II-II of *Figure 1*,
through a second rotary section of the wind powered generator of *Figure 1*;

Figure 6 shows adjustable air flow control means arranged to control
the flow of air into an air inlet region of a wind powered generator
embodying the present invention;

Figure 7 shows an enlarged view of the wind powered generator shown in *Figure 1*;

Figure 8 shows a simplified schematic (with a cut-away section) of an arrangement of current generating means utilisable in a wind generator embodying the present invention;

Figure 9 shows *Figure 9* shows a simplified schematic (with cut-away sections) of the arrangement of the current generating means and the rotary parts of the wind powered generator shown in *Figure 1*;

Figure 10 is a diagrammatic longitudinal section view, along the line III-III of *Figure 1*, through the wind powered generator shown in *Figure 1*;

Figure 11 is a diagrammatic longitudinal section view through a wind powered generator embodying the present invention;

Figure 12 shows a rotary part configured to allow air to flow therethrough during rotation, utilisable in a wind powered generator embodying the present invention.

Written Description of the Best Mode for Carrying Out the Invention

Figure 1

A wind powered generator 101 embodying the present invention is shown in *Figure 1*. The illustrated generator 101 is configured to be positioned in a natural wind environment and, in this example, is shown situated on the roof 102 of a building 103. An engineer 104 is shown standing adjacent the wind powered generator 101, performing routine maintenance and inspection work upon the generator 101.

As shown, generator 101 comprises a first rotary section 105, a second rotary section 106, a third rotary section 107 and a generator electrical means section 108. Generator 101 is also equipped with inlet ducting means 109 and outlet ducting means 110. Air flow through the generator 101 is indicated generally by arrows A and B.

Within each of the three rotary sections 105, 106, 107 of generator 101 is a rotary part. An example of a rotary part utilisable in a wind generator embodying the present invention is shown in *Figure 2*.

10 ***Figure 2***

Rotary part 201 is arranged to rotate about an axis when exposed to a flow of air perpendicular to the axis of rotation. In the example shown in *Figure 2*, rotary part 201 is arranged to rotate about an axial shaft 202, and comprises a hub 203 from which four arcuate vanes 204, 205, 206, 207 extend; alternatively a rotary part having one or more vanes is utilisable. The vanes 204, 205, 206, 207 are evenly distributed about the circumference of the hub 203. Each vane 204, 205, 206, 207 has three free edges, for example, edges 208, 209 and 210 of vane 204; with edges 208 and 210 being side edges, and edge 209 being the front edge, of vane 204.

20 Rotary part 201 is arranged to rotate in a first direction, indicated by arrow C, about axial shaft 202 when exposed to a flow of air perpendicular to axial shaft 202, in the direction indicated by arrow D; in response to rotative air impinging on the underside of a vane, for example the underside 211 of vane 205.

As rotary part 201 rotates, each vane 204, 205, 206, 207 demarcates a vane free edge path 212 and a vane front edge path 213; a vane free edge path 212 being the path the free edges of a vane 204, 205, 206, 207 travel as the rotary part 201 rotates, and a vane front edge path 213 being the path the front edge of a vane 204, 205, 206, 207 travels as the rotary part 201 rotates.

Figure 3

Figure 3 illustrates rotary part barrier means 301 arranged in stationary relation to rotary part 201. Barrier means 301 is configured to provide a barrier sector for rotary part 201, for example barrier sector 302 comprising a barrier around a portion of the vane free edge path 212 of rotary part 201, extending between an air inlet region 303 in which a portion of the vane front edge path 213 is exposed to allow the underside of a vane 204, 205, 206, 207 to be exposed to a flow of air and an air outlet region 304 in which a portion of the vane front edge path 213 is exposed to allow the underside of a vane 204, 205, 206, 207 to be exposed following rotation through the barrier sector 302. According to the example shown in Figure 3, as rotary part 201 rotates in the direction indicated by arrow C, inflowing air, as indicated by arrow E, flows through air inlet region 303 and is discharged through air outlet region 304, as indicated by arrow F.

In the example shown in Figure 3, barrier means provides a second barrier sector between air outlet region 304 and air inlet region 303, in the direction indicated by arrow C. First and second portions of the free edge

vane path of rotary part **201** are exposed in air inlet region **303** and air outlet region **304** respectively.

Barrier means **301** is configured to inhibit air which follows a vane **204, 205, 206, 207** rotating into a barrier sector from discharging outside of the vane free edge path **212** whilst that vane **204, 205, 206, 207** is rotating through the barrier sector. In this way, the barrier means **301** functions to enhance the rotative effect of air entering the barrier sector.

In the example shown in *Figure 3*, barrier means **301** is configured to provide two barrier sectors which each extend over the distance between the front edge of two vanes **204, 205, 206, 207** of rotary part **201**. Thus, barrier means **301** is configured to provide two barrier sectors each of approximately ninety degrees.

Figure 4

Figure 4 shows a simplified section view, along the line I-I shown in *Figure 1*, through the first rotary section 105 of wind powered generator **101**. First rotary part **401**, which comprises a hub **402** and four arcuate vanes **403, 404, 405, 406** extending therefrom in a similar arrangement to that of rotary part **201**, is arranged to rotate about an axis of rotation through the centre of axial shaft **407**.

Arranged in stationary relation to rotary part **401**, is barrier means **408** providing first and second barrier sectors between an air inlet region **409** and an air outlet region **410**.

Inlet ducting **109** is arranged to direct inflowing air, flowing in the

direction generally indicated by arrow A, towards air inlet region **409**. In the illustrated example, inlet air ducting **109** is arranged to direct a flow of air through the air inlet region **409** such that the air impinges on the underside of a vane **403**, **404**, **405**, **406** to rotate the rotary part **401** in the direction indicated by arrows F (in *Figure 4*, this direction is clockwise from inlet air ducting **109** to outlet air ducting **110**). Air flowing through the barrier means **408** from air inlet region **409** is discharged through air outlet region **410**. Outlet air ducting **110** is arranged to direct outflowing air, flowing in the direction generally indicated by arrow B, away from air outlet region **410**.

In this example, the area of air inlet region **409** is approximately half that of the area of air outlet region **410**. This relationship provides for a partial vacuum to be created within the vane free edge path of rotary part **401** at the air outlet region **410**, as rotary part **401** rotates in the direction indicated by arrows F; to enhance the rotative effects of air flowing from air inlet region **409**.

In addition, barrier means **408** is configured to provide two barrier sectors between air inlet region **409** and air outlet region **410**, in the direction indicated by arrows G, arranged to provide for a vortex to be created within the vane free edge path of rotary part **401** as rotary part **401** rotates; a vortex enhancing the rotative effects of air flowing in the vane free edge path of rotary part **401**.

Rotary part **401** also comprises binding means, in the shown configuration, between the front edge of each vane **403**, **404**, **405**, **406** and the bottom of the succeeding vane **403**, **404**, **405**, **406**, extending between

the underside of the vane 403, 404, 405, 406 and the topside of the succeeding vane 403, 404, 405, 406; for example cable 411 extending between the underside 412 of vane 404 and the topside 413 of vane 405. Rotary part binding means are configurable to stabilise the relative positions of the vanes 403, 404, 405, 406, as rotary part 401 rotates, to regulate the amount of deflection experienced by the vanes 403, 404, 405, 406 as rotary part 401 rotates and/or such that a vane 403, 404, 405, 406 being acted upon by rotative air flows a succeeding vane 403, 404, 405, 406.

Figure 5

Figure 5 shows a simplified section view, along the line II-II shown in Figure 1 (in the same direction as along parallel line I-I), through the second rotary section 106 of wind powered generator 101. Second rotary part 501, which comprises a hub 502, four arcuate vanes 503, 504, 505, 506 extending therefrom and binding means, in a similar arrangement to that of rotary part 401. Rotary part 501 is also arranged to rotate about the same axis of rotation along the centre of axial shaft 407 as rotary part 401.

Arranged in stationary relation to rotary part 501, is barrier means 507, providing first and second barrier sectors between an air inlet region 508 and an air outlet region 509. In this example, the area of air inlet region 508 is approximately half that of the area of air outlet region 509.

Inlet ducting 109 is arranged to direct inflowing air, flowing in the direction generally indicated by arrow A, towards air inlet region 508. In the

illustrated example, inlet air ducting **109** is arranged to direct a flow of air through the air inlet region **508** such that the air impinges on the underside of a vane **503**, **504**, **505**, **506** to rotate rotary part **501** in the direction indicated by arrows H (in *Figure 5*, this direction is anti-clockwise from inlet air ducting **109** to outlet air ducting **110**). Thus, rotary part **501** is arranged to rotate about axial shaft **407** in the opposite direction to rotary part **401** when exposed to the same air flow through the generator **101**, indicated in *Figures 1*, *4* and *5* generally by arrows A and B. Air flowing through the barrier means **507** from air inlet region **508** is discharged through air outlet region **509**. Outlet air ducting **110** is arranged to direct outflowing air, flowing in the direction generally indicated by arrow B, away from air outlet region **509**.

Third rotary section **107** of wind powered generator **101** is similar in arrangement to rotary section **105**, with the third rotary part (shown in *Figure 9*) being similar to first rotary part **401** and arranged to rotate in the same direction about the axis of rotation along the centre of axial shaft **407**.

Figure 6

Wind powered generators installed in natural wind environments are subject to fluctuations in the inflowing air flow.

Figure 6 shows the same arrangement as shown in *Figure 5*, with the addition of adjustable air flow control means **601**, configured to provide a means of regulating the flow of air into air inlet region **602**. In this example, air flow control means **601** is a screen configured to be moveable in the directions indicated by double-headed arrow J, between a fully open

position, in which the air flow through air inlet region **602** is unrestricted by the air flow control means **601**, and a fully closed position, in which the air flow control means **601** prevents the inflow of air from the inlet air ducting **603** through air inlet region **602**. In the example shown in *Figure 6*, inlet air ducting **603** is configured to receive the air flow control means screen **601** in a channel **604** formed therein. Alternative embodiments of air flow control means include shutters and venetian blind style arrangements.

Figure 7

As shown in *Figure 7*, which shows an enlarged view of wind powered generator **101**, inlet air ducting **109** is arranged to have an inlet **701**, allowing air to flow into the inlet air ducting **109** from the natural wind environment, common to rotary sections **105**, **106**, **107**, and an outlet **702**, **703**, **704** individual to each rotary section **105**, **106**, **107** respectively, allowing air to flow from the inlet air ducting **109** into the air inlet region of each rotary part in each rotary section **105**, **106**, **107**. Thus, inlet air ducting **109** has a single inlet **701** common to rotary sections **105**, **106**, **107** and three outlets **702**, **703**, **704**.

Alternative inlet air ducting includes ducting having an inlet common to more than one rotary section, ducting having an outlet common to more than one rotary section, ducting having an inlet and an outlet individual to a rotary section and ducting having combinations thereof.

Outlet air ducting **110** is arranged to have an inlet **705**, **706**, **707** allowing air to flow into the outlet air ducting **110** from the air outlet region of

each rotary part in each rotary section 105, 106, 107, individual to each rotary section 105, 106, 107 respectively, and an outlet 708, 709, 710 individual to each rotary section 105, 106, 107 respectively, allowing air to flow from the outlet air ducting 110 into the natural wind environment. Thus, outlet air ducting 110 has three inlets 705, 706, 707 and three outlets 708, 709, 710.

Alternative outlet air ducting includes ducting having an inlet common to more than one rotary section, ducting having an outlet common to more than one rotary section, ducting having an inlet and an outlet individual to a rotary section and ducting having combinations thereof.

Air inlet ducting and air outlet ducting that is all or in part releasably attachable to a wind powered generator is utilisable. This feature allows for a number of wind powered generators of similar construction to be equipped with different ducting, for example according to the installation site of the wind powered generator or the wind environment, whether the wind environment is natural or not. Removable ducting provides for more convenient maintenance of, and transportation of, a wind powered generator embodying the present invention.

Air inlet ducting and outlet ducting that is configured to be adjustable is utilisable. For example, a configuration of air inlet ducting has an inlet section that is adjustable such that the inlet is directable into a flow of air.

Due to the potential variability of ducting between wind powered generators embodying the present invention, the position and construction of air flow control means is correspondingly variable. For example,

alternative embodiments of air flow control means includes air flow control means individual to a rotary section, or air flow control means common to more than one rotary section. In addition, the position of air flow control means relative to a rotary section is also variable, for example, referring to inlet air ducting means 109 shown in *Figure 7*, air flow control means may be positioned at each of the outlets 702, 703, 704 or may be positioned at the common inlet 701. Air flow control means may be operated manually, in response to data received from sensors, via a control program, with controls at or remote from the wind powered generator. Each air flow control means may be arranged to be adjusted independently of each other and/or in common with another.

Figure 8

In a wind powered generator embodying the present invention, at least one rotary part is operatively connected to current generating means comprising generator means and second generator means arranged to generate electric current in response to relative rotation between said first and second generator means.

Figure 8 shows a simplified schematic (with a cut-away section) of an example arrangement of current generating means utilisable in a wind generator embodying the present invention. Current generating means 801 comprises first generator means 802 and second generator means 803; in this example, first generator means 802 is fixedly mounted about an axial shaft 804 and second generator means 803 is arranged about first

generator means **802**, such that the first and second generator means **802**, **803** are concentric about an axis of rotation along the centre of axial shaft **804**.

According to the shown arrangement, first generator means **802** comprises an electrical armature comprising a soft iron core **805** about which electrical windings **806** configured to carry electric current are wound, and second generator means **803** comprises a plurality of permanent magnets **807** secured in a sleeve **808**. This arrangement is a sleeve arrangement, in which the permanent magnets **807** are portably held in position relative to each other.

With the arrangement shown in *Figure 8*, electric current is generated in response to relative rotation between the first and second generator means **802**, **803**, for example in response to the rotation of one of the first and second generator means **802**, **803** relative to the other of the first and second generator means **802**, **803** with only one, or both, being rotatable about the axis of rotation through axial shaft **804** relative to the other.

Figure 9

Figure 9 shows a simplified schematic (with a cut-away sections) of the arrangement of the current generating means and the first, second and third rotary parts **401**, **501**, **901** respectively of wind powered generator **101**.

As described previously, the first, second and third parts **401**, **501**,

901 are arranged to rotate about an axis of rotation along the centre of axial shaft 407. First and third rotary parts 401, 901 are arranged to rotate in a first direction about the axis of rotation, indicated by arrows K, and second rotary part 501, which is interposed between the first and third rotary parts 401, 901, is arranged to rotate in the opposite second direction about the axis of rotation, indicated by arrow L, when the air inlet region associated with each rotary part 401, 501, 901 is exposed to a flow of air perpendicular to the axis of rotation, indicated generally by arrow M.

As shown in *Figure 9*, the hub 502 of rotary part 501 is substantially hollow. Similarly, the hub 402, 902 of first and third rotary parts 401, 901 are substantially hollow. The hub of a rotary part utilised by a wind powered generator embodying the present invention may or may not be substantially hollow, for example, according to the arrangement of the rotary part relative to the generator means of the wind powered generator and/or to reduce the weight of a rotary part.

The current generating means 903 utilised in wind powered generator 101 comprises first generator means 904 and second generator means 905. First generator means 904 is mounted about axial shaft 407, within the hub 502 of second rotary part 501. Second generator means 905 is arranged within the hub of second rotary part 501, about first generator means 904, such that the first and second generator means 904, 905 are concentric about the axis of rotation through axial shaft 407.

First and third rotary parts 401, 901 are operatively connected to first generator means 904. First and third rotary parts 401, 901 are operatively

connected to first generator means **904** such that as the first and third rotary parts **401**, **901** rotate in a first direction about the axis of rotation, for example in the direction indicated by arrow K, first generator means **904** is rotated in the same direction. First and third rotary parts **401**, **901**, and first generator means **904** are fixedly mounted about axial shaft **407**, such that axial shaft **407** is rotated in the same direction. According to this arrangement, axial shaft **407** is journalled on bearings provided by a support structure (not shown).

Second rotary part is operatively connected to second generator means **905**. Second rotary part is operatively connected to second generator means **905** such that as the second rotary part **501** rotates in a first direction about the axis of rotation, for example in the direction indicated by arrow L, second generator means **904** is rotated in the same direction. Second rotary part **502** is mounted about axial shaft **407** such that second rotary part **502** rotates around axial shaft **407**.

Thus, wind powered generator **101** is configured to provide for contra-rotation of the first and second generator means **904**, **905**.

In this example, first generator means **904** comprises an electrical armature comprising a soft iron core **906** about which electric windings **907** configured to carry electrical current are wound, and second generator means **905** comprises a plurality of permanent magnets **908** secured in a sleeve **909**. A sleeve arrangement facilitates construction of a wind generator embodying the present invention, provides for generator means to be secured in a sleeve arrangement utilising a different material

to that utilised in a rotary part, allows generator means to be secured to a rotary part indirectly, and facilitates the arrangement of a uniform air gap between first and second generator means. In this example, sleeve 909 is configured to be removably secured to second rotary part 501.

5 Alternatively, the permanent magnets 908 may be directly secured within hub 502.

As shown in *Figure 9*, the first and third rotary parts 401, 901 are mounted about axial shaft 407 such that the vanes of each rotary part 401, 901 are out of phase with each other. Associated with each of the first and

10 third rotary sections 105, 107 is an air inlet region for each of the first and third rotary parts 401, 901, and this feature provides for a vane of either the first and third rotary parts 401, 901, to be exposed in one of these two air inlet regions at any moment in time.

Alternatively, as shown in *Figure 10*, the first and third rotary parts

15 401, 901 are mounted about axial shaft 407 such that the vanes of each rotary part 401, 901 are in phase with each other.

Figure 10

Figure 10 is a diagrammatic longitudinal section view, along the line

20 III-III shown in *Figure 1*, through the first, second and third rotary section 105, 106, 107 and the generator electrical means section 108. As shown in *Figure 10*, axial shaft 407 is configured to receive electrical connection means 1001 therethrough. Electrical connection means 1001 is configured to provide an electrical connection between the current generating means

903 and generator electrical means **1002**. Generator electrical means **1002** is positioned inside generator electrical means section **108**, which is positioned outside of the rotary sections **105**, **106**, **107** of the wind powered generator **101**. This feature facilitates the construction, transport and maintenance of wind powered generator **101**.

In this example, the electrical connection means **1001** electrically connects the current carrying windings **907** of first generator means **904** with slip rings and brushes contained in the generator electrical means section **108**. According to the shown arrangement, the electrical connection means **1001** comprises extension lengths of the windings **907** extending from the armature core **906** to the generator electrical means **1002**. Alternatively, electrical connection means connected to the windings is utilisable.

As shown, electrical connection means **1001** does not extend all the way through axial shaft **407**. Thus, an alternative configuration of shaft configured to receive electrical connection means therethrough is configured to receive electrical connection means through a part of the full length of the shaft.

The shown electrical arrangement utilised by wind powered generator **101** is such that alternating electric current (a.c.) is generated. Alternatively, an electrical arrangement of current generating means configured to generate direct current (d.c.) is utilisable. The components of the generator electrical means are thus variable depending on the current generating means utilised. For example, externally or self excited

electromagnets may be utilised in place of permanent magnets. Shafts utilisable in a wind powered generator embodying the present invention include shafts configured to receive therethrough a single, or multiple pairs of electric current carrying connections, for example electric cables. A utilisable shaft is provided with packing material, for example electrically insulating material, to surround, cushion and/or position electrical connection means within the shaft.

Figure 11

Figure 11 is a diagrammatic longitudinal section view through a wind powered generator **1101** embodying the present invention. Wind powered generator **1101** is similar in construction to wind powered generator **101**, configured as a modular assembly. The axial shaft **1102** is configured in first, second, third and fourth sections **1103**, **1104**, **1105**, **1106** corresponding to first, second and third rotary sections **1107**, **1108**, **1109** and generator electrical means section **1110** respectively. Each section **1103**, **1104**, **1105**, **1106** is configured to be releasably engageable with at least one other section. In the illustrated example, at least one end of each section **1103**, **1104**, **1105**, **1106** is castellated.

Electrical connection means **1111** is also configured to be separable into sections **1112**, **1113**, **1114**. At least one end of each section is provided with an electrical connection junction section, configured to be releasably engageable with at least one other junction section. For example, junction section **1115** of electrical connection means section **1112**

is configured to be releasably engaged with junction section 1116 of electrical connection means section 1113.

This feature facilitates the transport, construction, and maintenance of wind powered generator 101, and facilitates the replacement of a section or component thereof.

Figure 12

Figure 12 shows a rotary part 1201 utilisable in a wind powered generator embodying the present invention, having a hub 1202 configured to allow air to flow through the rotary part 1201, in particular as the rotary part 1201 rotates. For example, rotary part 1201 is configured such that as rotary part 1201 rotates in the direction indicated by arrow N, air flows into the hub 1202, in the direction indicated by arrow P, through the hub 1202 and flows out of the hub 1202, in the direction indicated by arrow Q. Rotary part 1201 is configured such that as rotary part 1201 rotates in a first direction about an axis of rotation, air flows through the hub 1202 in a direction along the axis of rotation. This feature provides for air flow through the rotary part 1201, to cool any generator means or electrical connection means inside the rotary part 1201.

Claims

1. A generator for generating an electric current comprising
current generating means comprising first generator means and
5 second generator means arranged to generate electric current in response
to relative rotation between said first and second generator means;

a first rotary part having vanes, said first rotary part arranged to
rotate in a first direction around an axis when exposed to a flow of air
perpendicular to said axis;

10 said first rotary part operatively connected to a first of said first and
second generator means; wherein

said generator further comprises first rotary part barrier means
arranged in stationary relation to said first rotary part, said barrier means
configured to provide a barrier sector comprising a barrier around a portion
15 of the vane free edge path of said first rotary part, said barrier extending
between an air inlet region in which a portion of the vane front edge path is
exposed to allow the underside of a vane to be exposed to a flow of air, and
an air outlet region in which a portion of the vane front edge path is
exposed to allow the underside of a vane to be exposed following rotation
20 through said barrier sector to allow the discharging of air,

said barrier means configured to inhibit air which follows a vane
rotating into said barrier sector from discharging outside of the vane free
edge path whilst said vane is rotating through said barrier sector.

2. A generator according to claim 1, further comprising a second rotary part having vanes, said second rotary part arranged to rotate in a second opposite direction around said axis when exposed to a flow of air perpendicular to said axis; said second rotary part operatively connected to the second of said first and second generator means; and second rotary part barrier means configured to provide a barrier sector comprising a barrier around a portion of the vane free edge path of said rotary part, said barrier means configured to inhibit air which follows a vane rotating into said barrier sector from discharging outside of the vane free edge path whilst said vane is rotating through said barrier sector.

3. A generator according to claim 1 or claim 2, further comprising a third rotary part having vanes, said third rotary part arranged to rotate in the same direction as another rotary part and operatively connected to the same generator means; and third rotary part barrier means configured to provide a barrier sector comprising a barrier around a portion of the vane free edge path of said rotary part, said barrier means configured to inhibit air which follows a vane rotating into said barrier sector from discharging outside of the vane free edge path whilst said vane is rotating through said barrier sector.

4. A generator for generating an electric current comprising current generating means comprising first generator means and second generator means arranged to generate electric current in response

to relative rotation between said first and second generator means;

a first rotary part having vanes, said first rotary part arranged to rotate in a first direction around an axis when exposed to a flow of air perpendicular to said axis; said first rotary part operatively connected to a first of said first and second generator means; and

said axis is through an axial shaft about which said rotary part is arranged to rotate, wherein

said axial shaft is configured to receive electrical connection means therethrough, said electrical connection means configured to provide an electrical connection between said current generating means and generator electrical means.

5. A generator according to claim 4, further comprising a second rotary part having vanes, said second rotary part arranged to rotate in a second opposite direction around said axis when exposed to a flow of air perpendicular to said axis; said second rotary part operatively connected to a second of said first and second generator means.

6. A generator according to claim 4 or claim 5, further comprising a third rotary part arranged to rotate in the same direction as, and operatively connected to the same generator means as, another rotary part.

7. A generator according to any of claims 4 to 6, wherein said generator electrical means are positioned outside of the rotary sections of

said generator.

8. A generator according to any of claims 4 to 7 comprising at least one barrier means arranged in stationary relation to a rotary part, said
5 barrier means configured to provide a barrier sector comprising a barrier around a portion of the vane free edge path of said rotary part,

said barrier means configured to inhibit air which follows a vane rotating into said barrier sector from discharging outside of the vane free edge path whilst said vane is rotating through said barrier sector.

10

9. A generator according to claim 8, wherein said barrier extends between an air inlet region in which a portion of the vane front edge path is exposed to allow the underside of a vane to be exposed to a flow of air, and an air outlet region in which a portion of the vane front edge path is
15 exposed to allow the underside of a vane to be exposed following rotation through said barrier sector.

10. A generator according to any preceding claim, wherein said rotary parts are arranged to rotate around axis through an axial shaft comprising sections releasably engageable with at least one other section
20 such that said generator is configured as a modular assembly.

11. A generator according to claim 10 dependent upon claim 4, wherein said electrical connection means comprises sections releasably

engageable with at least one other section.

5 12. A generator according to any preceding claim comprising a rotary part configured to allow air to flow through said rotary part in a direction along said axis during rotation.

10 13. A generator according to any preceding claim comprising inlet air ducting arranged to direct a flow of air towards at least one air inlet region.

 14. A generator according to any preceding claim comprising outlet air ducting arranged to direct a flow of air away from at least one air outlet region.

15 15. A generator according to any preceding claim comprising adjustable air flow control means configured to control the flow of air into at least one air inlet region.

20 16. A generator according to any claim 3, claim 6 or any of claims 6 to 15, dependent upon claim 3 or claim 6, configured such that the vanes of said first rotary part and said third rotary part are out of phase with each other.

 17. A generator according to any preceding claim, wherein said

current generating means comprises generator means secured in a sleeve arrangement, said sleeve arrangement configured to be positioned inside a rotary part such that said generator means is arranged about said axis.

5 **18.** A generator according to claim 14, wherein said generator means comprises permanent magnets secured in a sleeve arrangement.

10 **19.** A generator according to claim 3 or claim 6, in which said first and third rotary parts are arranged to rotate in said first direction and are operatively connected to said first generator means, said first generator means comprising an armature, and said second rotary part is operatively connected to said second generator means, said second generator means comprising permanent magnets.

15 **20.** A generator according to claim 19, in which said first and second generator means are arranged within said second rotary part.

20 **21.** A generator according to claim 20 dependent upon claim 5 and claim 8, comprising barrier means for each of said first, second and third rotary parts.

22. A generator substantially as described herein with reference to *Figures 1 to 12*.

Abstract of the Disclosure

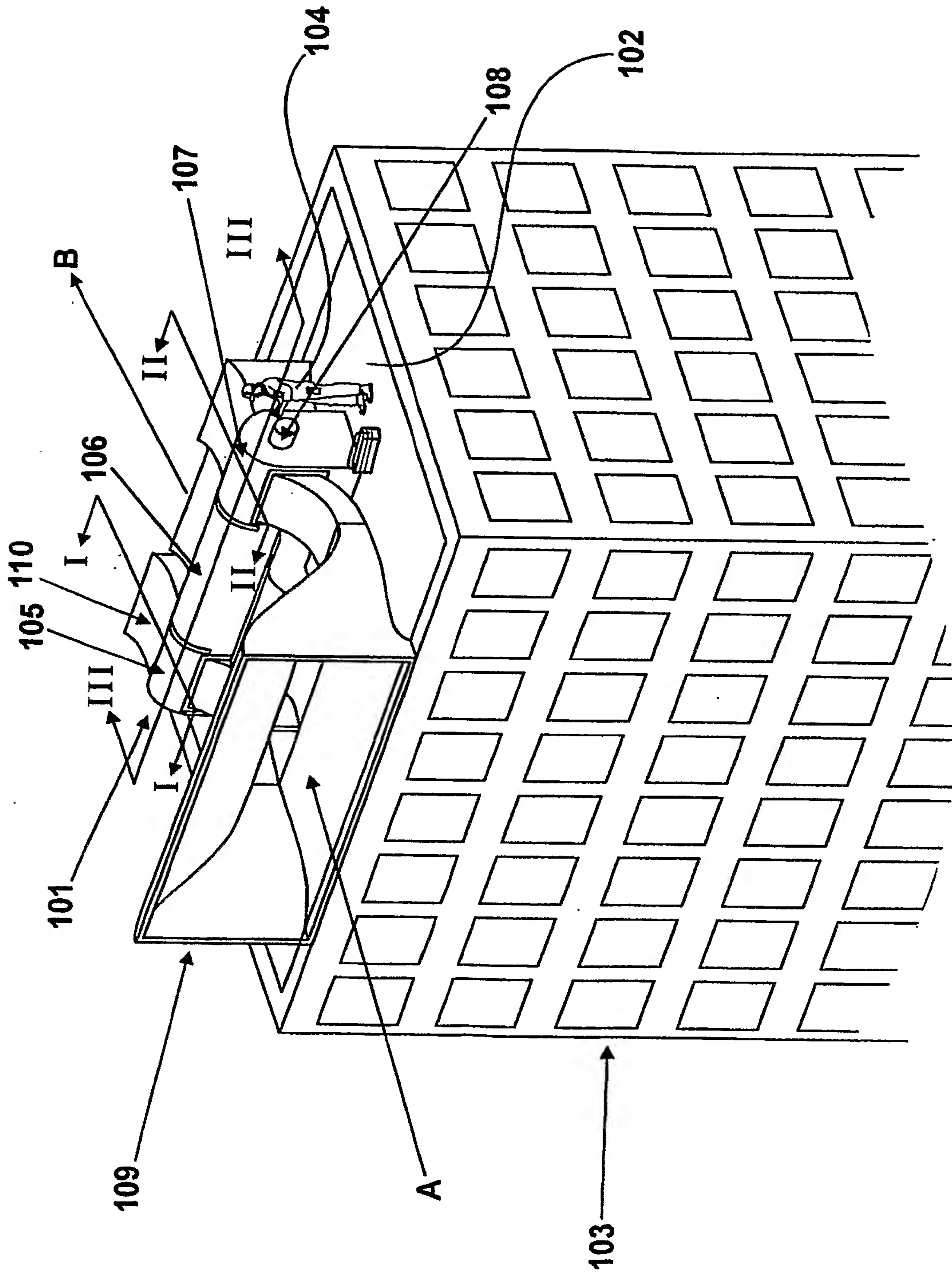
Generator

5

A wind powered generator comprising at least one rotary part operatively connected to current generating means comprising generator means and second generator means arranged to generate electric current in response to relative rotation between said first and second generator means. Rotary part barrier means arranged in stationary relation to a rotary part and configured to provide a barrier sector around a portion of the vane free edge path of the rotary part; the barrier means configured to inhibit air which follows a vane rotating into said barrier sector from discharging outside of the vane free edge path whilst said vane is rotating through said barrier sector. An axial shaft around which at least one rotary part is arranged to rotate, configured to receive electrical connection means therethrough.

20 *(Figure 7)*

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*Figure 1*

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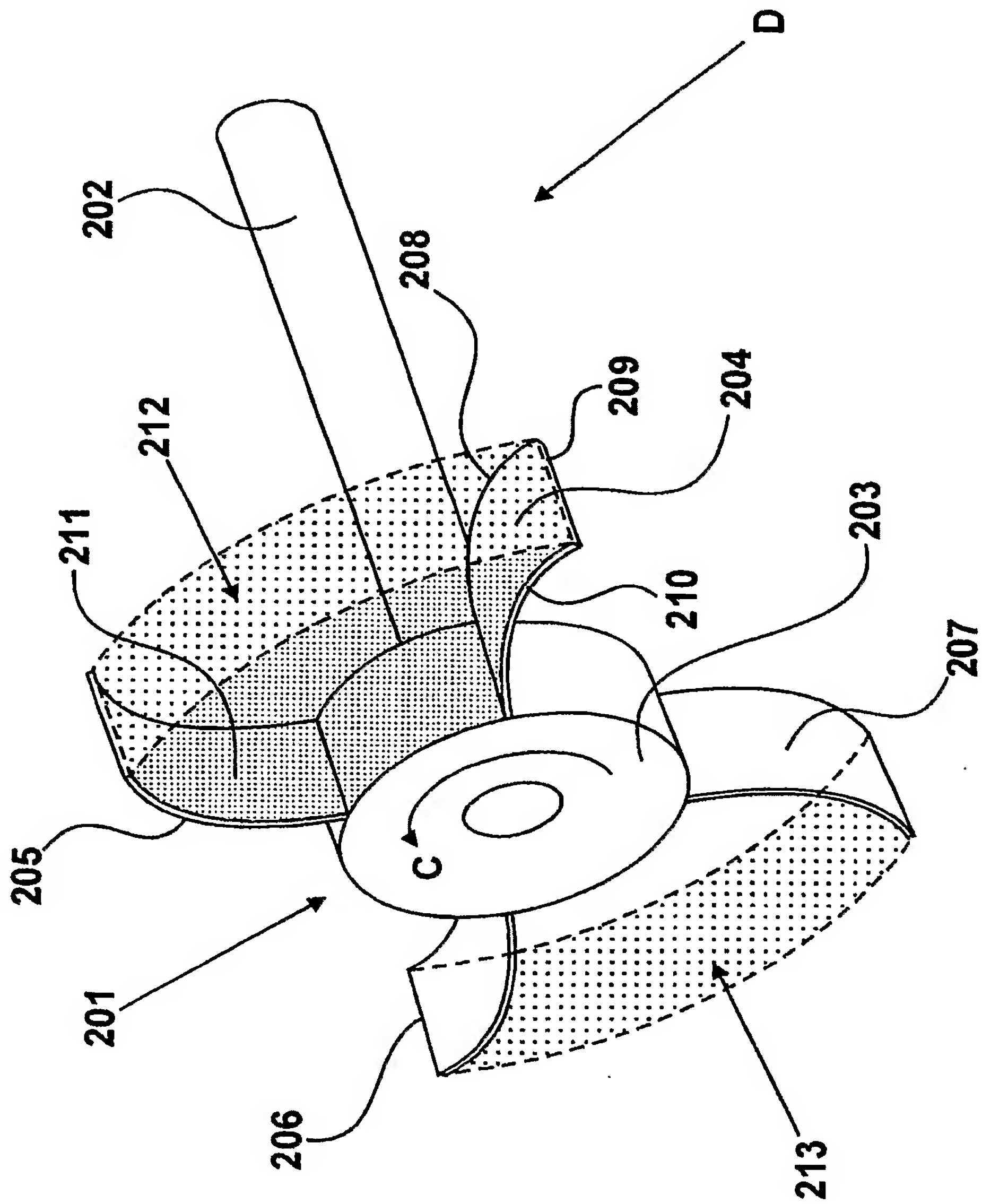


Figure 2

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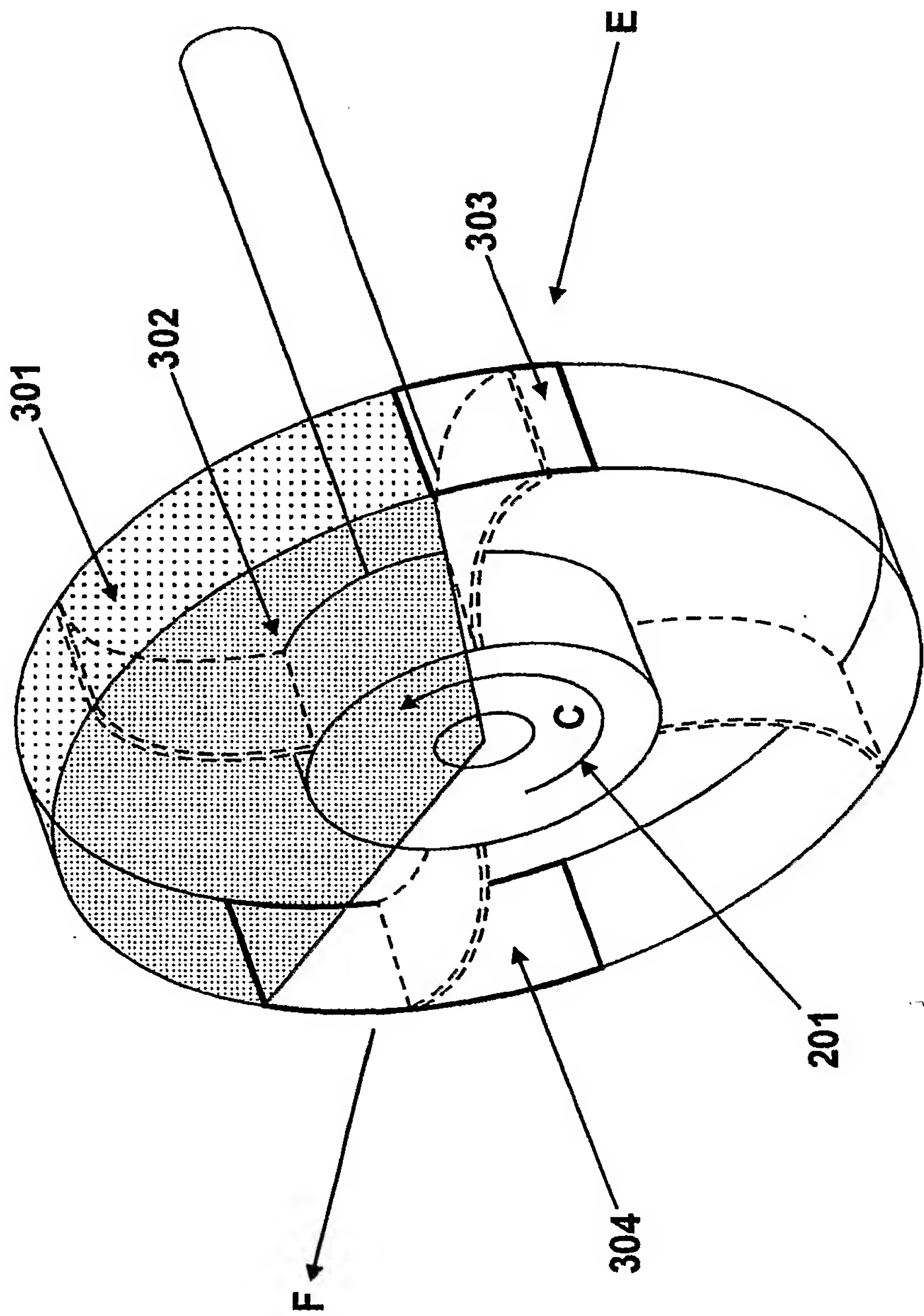


Figure 3

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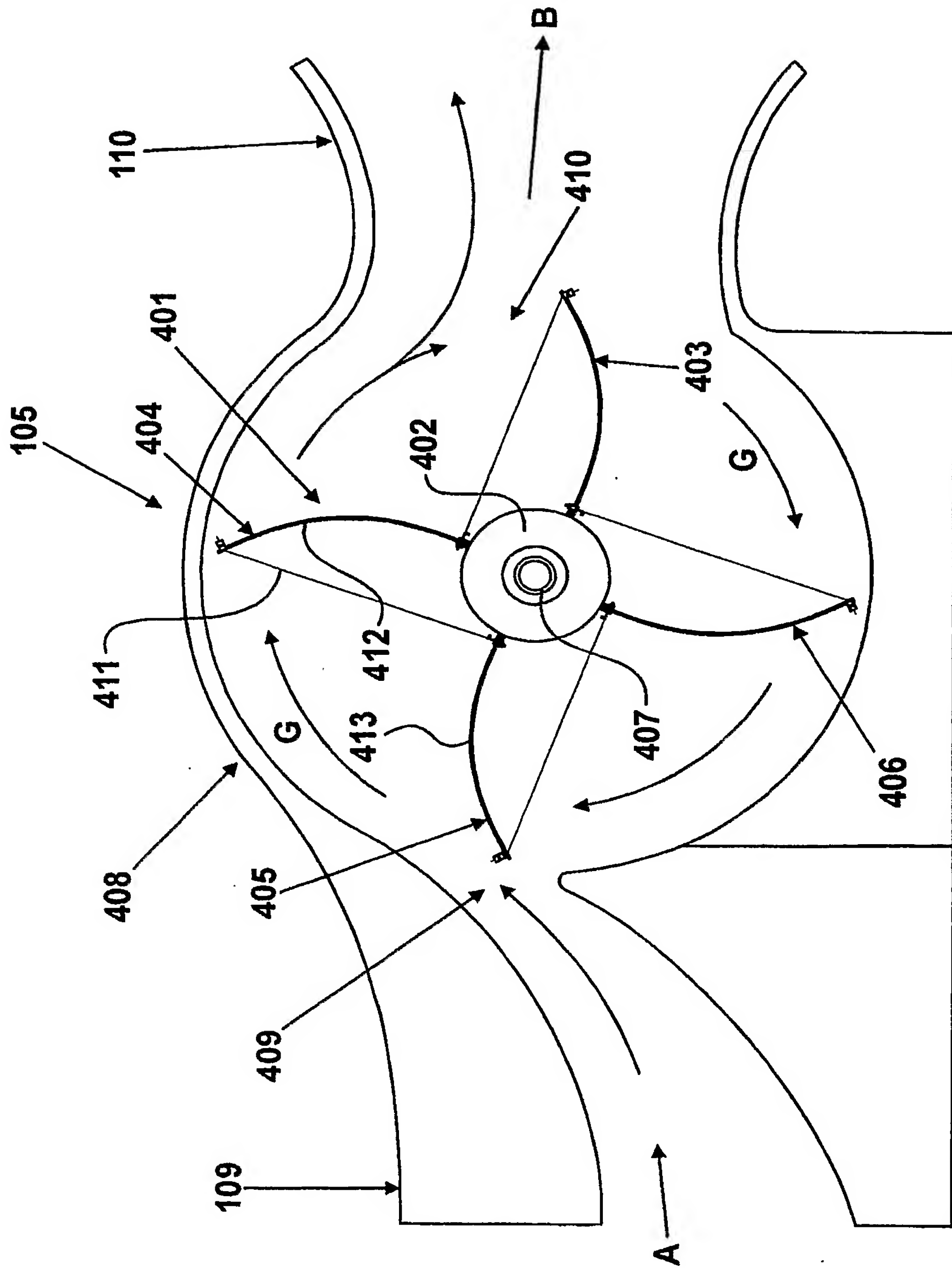
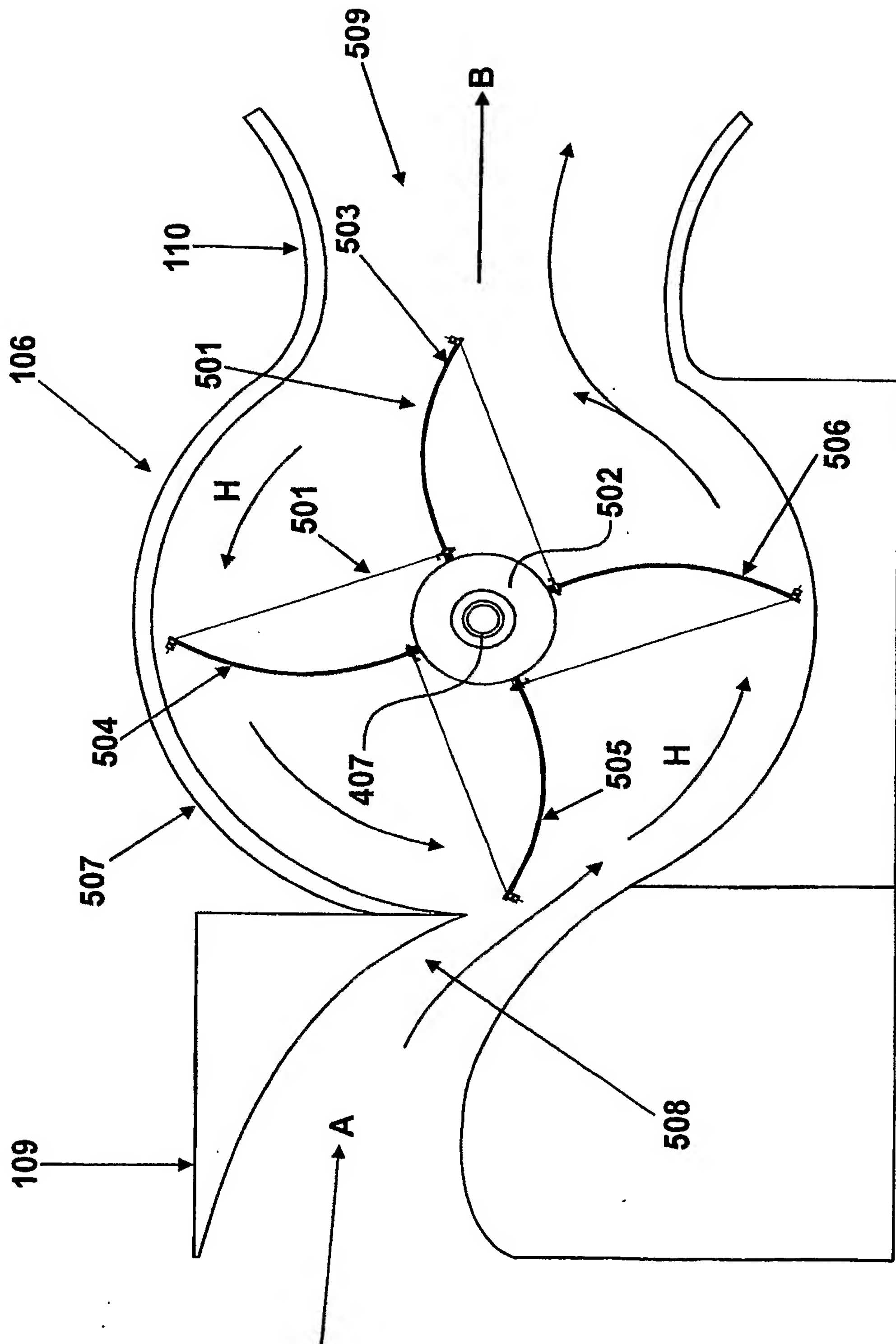


Figure 4

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*Figure 5*

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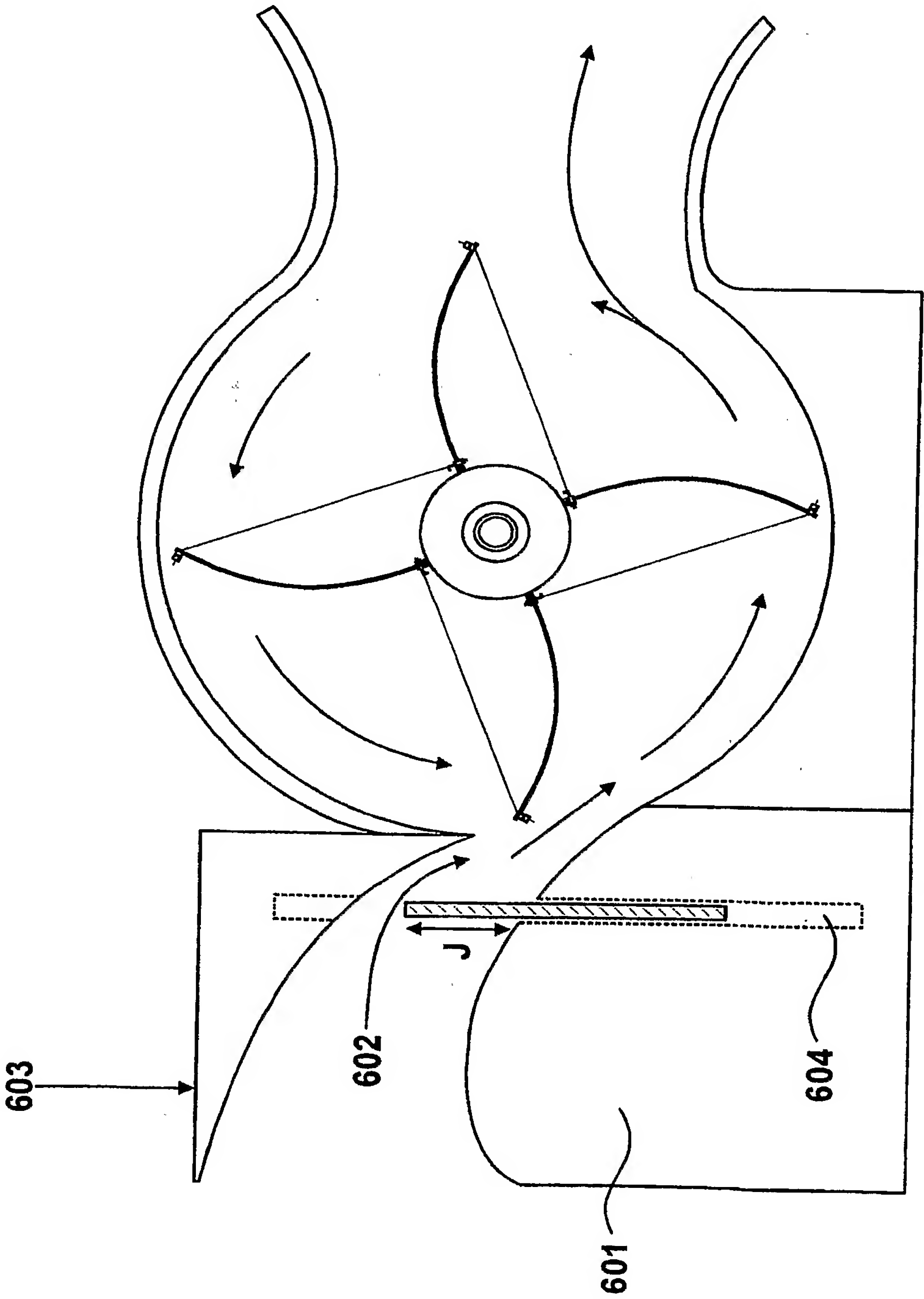


Figure 6

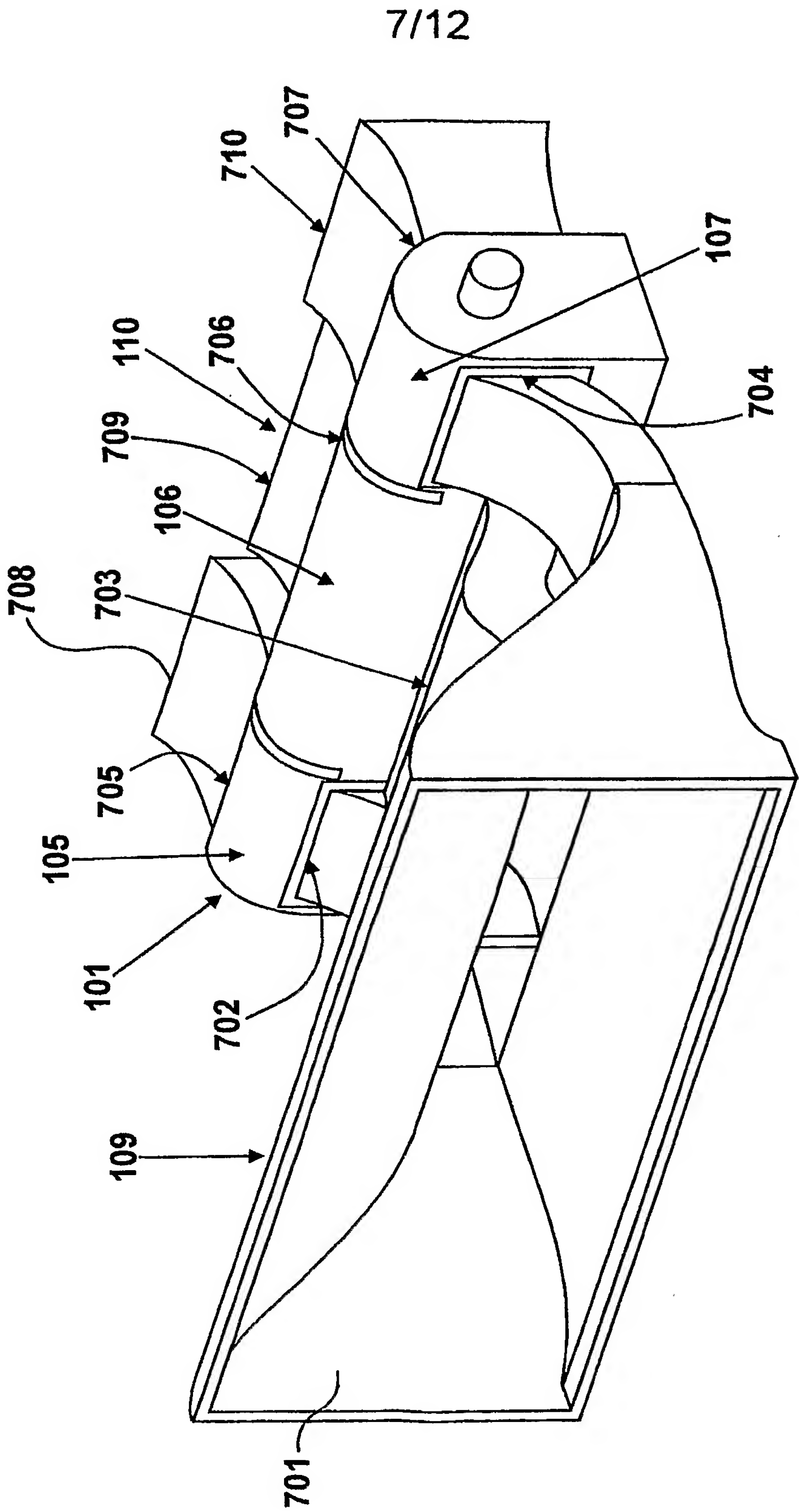


Figure 7

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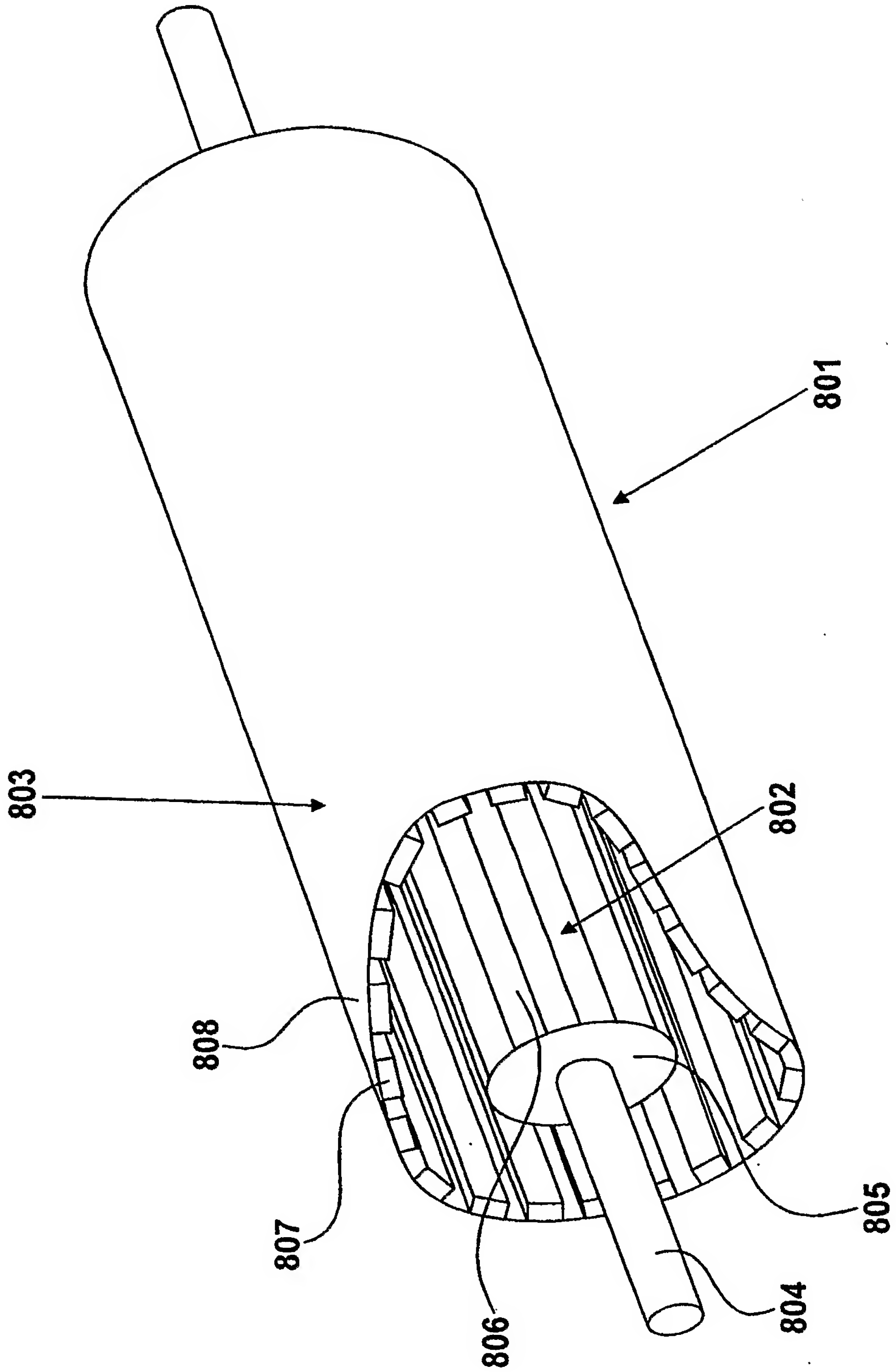


Figure 8

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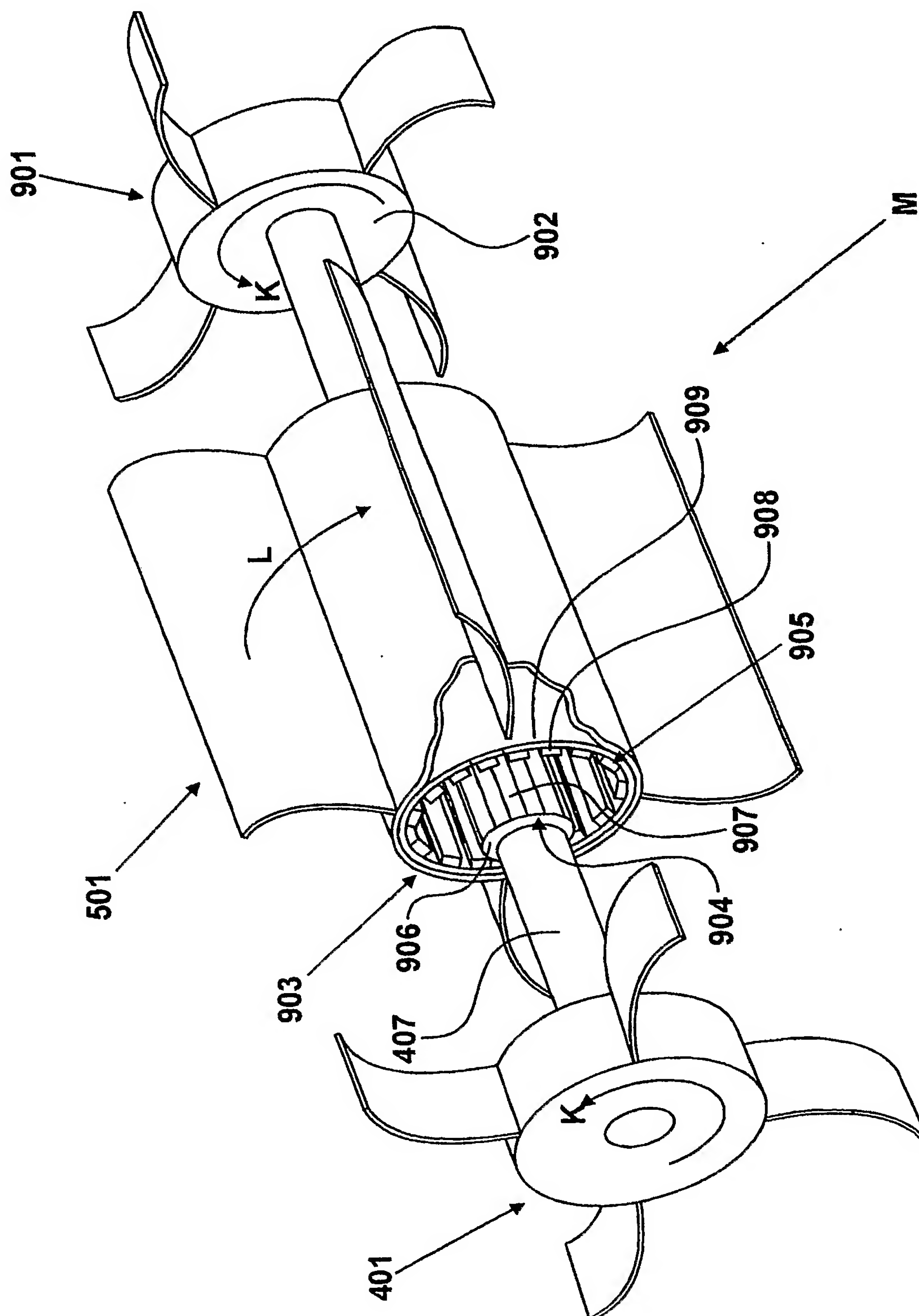


Figure 9

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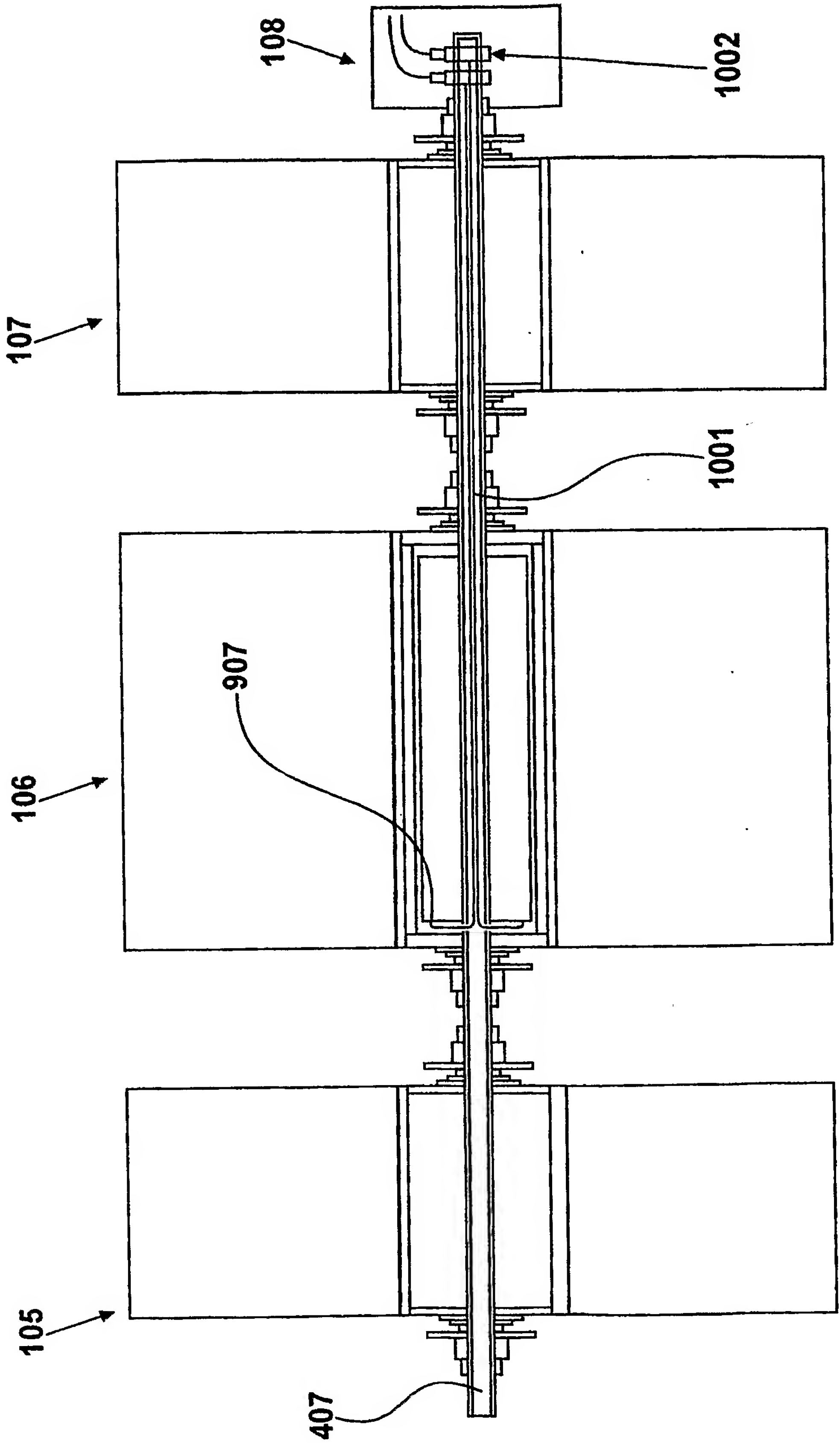
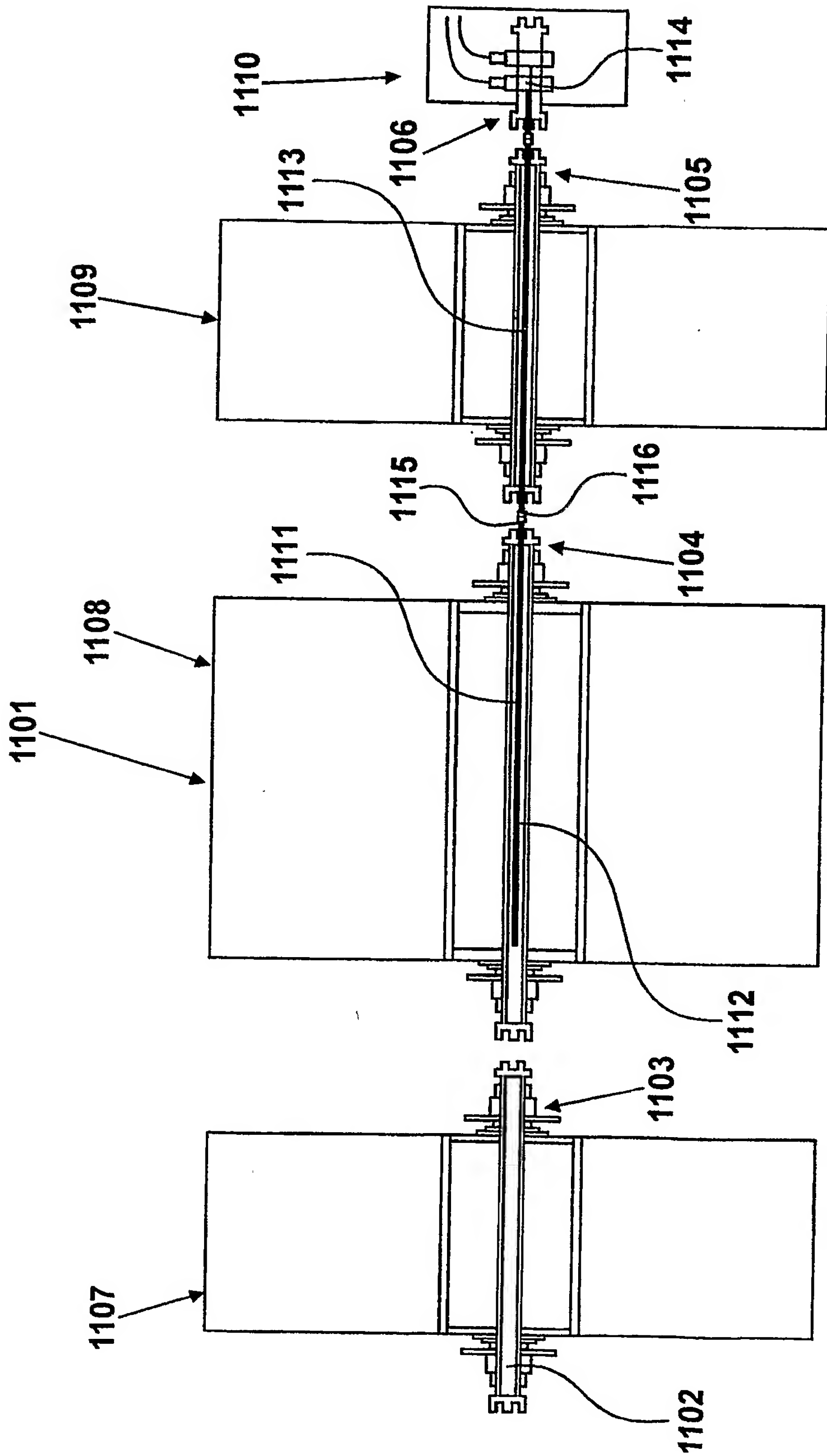
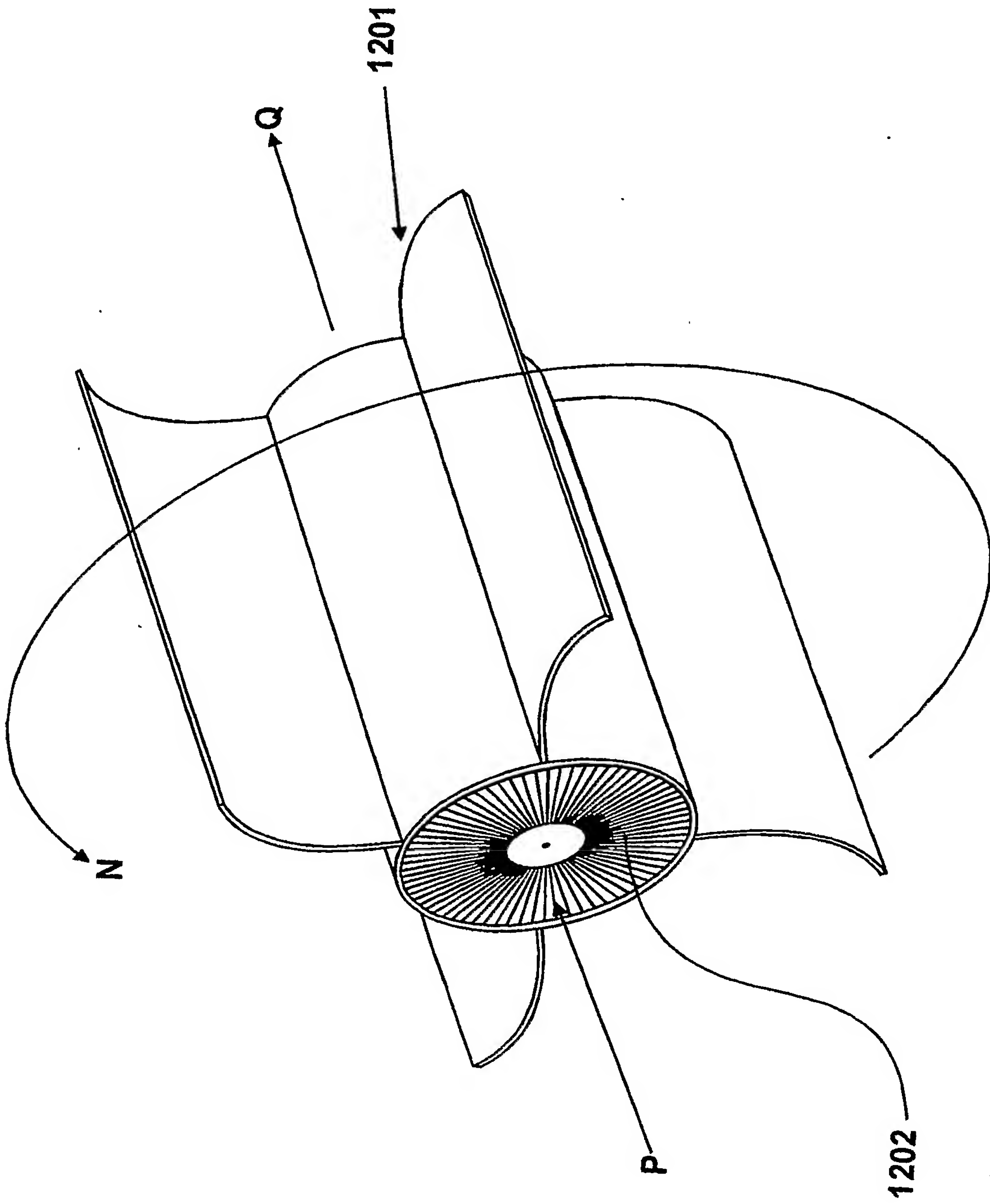


Figure 10

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*Figure 11*

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*Figure 12*